POSTOPERATIVE ILEUS.[1]

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AMONG the serious complications which may follow a surgical operation involving the opening of the abdominal cavity, there is none, except secondary hæmorrhage, which more urgently demands an early diagnosis and prompt relief than intestinal obstruction. In isolated instances it has been observed after operations where the peritoneal cavity was unopened. Just at the time when the surgeon has begun to be relieved somewhat of his anxiety, and to congratulate himself that once more his labors have been crowned with success, it is most disheartening to patient and surgeon alike to be confronted with the added perils of a secondary operation. Fortunate is he who has never been called upon to face this distressing situation, and but few surgeons there are, I fancy, with an operative practice at all extended, who cannot recall some such experience, for, unfortunately, postoperative ileus is not a rare affection.

It has been my misfortune to have met with twenty-six cases of postoperative ileus in my hospital and private practice, twenty-two of which required secondary operation of one sort or another; and I am sure, although I have not complete records of these cases, that during this time I have seen an equal number in the practice of my colleagues in the Johns Hopkins Hospital, and elsewhere.

Baisch,[1] in a recent historical review of postoperative ileus, gives to Sir Spencer Wells[2] the credit of the first description of this condition, in a paper published in 1860.

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[1] Read before the Chicago Surgical Society, February 28, 1906.

This case was due to an adhesion of a coil of intestine to the stump of an ovarian cyst. He also reports another case in which a loop of intestine was caught in the abdominal suture. Up to 1881, he had had one thousand ovariotomies, with eleven cases of postoperative ileus. These all died unoperated upon.

Schroeder[3] in 1878 was the first to operate for this complication. His patient died. A year later, Olshausen[4] reported a successful case. From this time, up to 1886, very little is found in the literature upon this subject.

Ileus following laparotomy was one of the subjects for discussion at the First Gynecological Congress, held in Munich, in 1886.

In 1894, Tuja[5] reported forty-three cases, five of which were surgical. In this same year, this subject was first brought prominently to the attention of the profession in this country by Rohe[6] of Baltimore, in his presidential address before the seventh annual meeting of the American Association of Obstetricians and Gynecologists, at Toronto. Previous to this time, all the reported cases had followed gynecological operations. Five years later, Schade[7] collected one hundred and twelve cases, many of which had followed operations for hernia. Corner[8] found from his study of St. Thomas's Hospital reports during the three years 1900–02 inclusive, that more postoperative obstructions occurred following vaginal hysterectomy than from all other pelvic operations combined.

Hawkins[9] in a study of two hundred and twenty-four cases of acute appendicitis, reports ten deaths, four from intestinal obstruction, six from other causes. Two per cent. of all the cases, and forty per cent. of the fatal ones, were due to intestinal obstruction.

In 1899, Werth[11] recommended enterostomy for the relief of intestinal obstruction.

Postoperative ileus, of which alone this paper treats, differs little from ileus in general, except in the matter of causation. The diagnosis in these cases may be frequently obscured by conditions which necessitated or were present at the time of the previous operation, infection, traumatism, influence of the anæsthetic, etc.

Attempts have been made to classify ileus, but, so far, a classification that is satisfactory to everyone has not been found. In the main, the classification of ileus in general applies to the postoperative variety, but with some modifications. Classified with reference to time, Broca's division of postoperative obstructions into two classes, early and late, is good, so far as it goes. The former class includes those cases which develop before the wound is completely healed, and contains by far the larger number of cases; the latter, those which develop after a period of perfect health of varying duration. The early cases present the greater difficulties in diagnosis owing to the fact that infection not infrequently plays a prominent part in the causation of the initial operation. The diagnosis of the late cases is, as a rule, comparatively easy, because of the absence of the element of infection.

Classified with reference to causation, the Mikulicz division into two main classes, mechanical and dynamic, is perhaps the most satisfactory. These in turn may be still further subdivided. Either of these varieties when unduly prolonged tends towards the development of the other, so that not infrequently they are associated in the same individual.

The two great factors concerned in the etiology of postoperative ileus are of either mechanical or septic origin. There is still a third and much smaller class in the development of which neither of these two forces is directly concerned, namely, those rare and interesting cases of adynamic ileus having their origin in disturbed conditions of the innervation and circulation of the intestine. We would, therefore, divide postoperative ileus into three main classes,—(*a*) mechanical, (*b*) septic, (*c*) adynamic. But a hard and fast distinction is difficult to maintain owing to the fact that they may all be present in the same individual.

The diagnosis of obstruction is all-important. Once this is established, the treatment is determined, since there is but one rational course to pursue. It, of course, is obvious that the earlier the diagnosis is made and the necessary relief accomplished the better. The main point to be determined in considering the question of diagnosis is, as a rule, to differentiate between the mechanical and the septic variety, since these are the two forms most often met with, the mechanical being very amenable to treatment, the septic to a less degree.

It is often difficult, sometimes impossible, to differentiate the mechanical form from the other forms of ileus, since neither condition presents any special symptom-complex which may not at times be simulated by the other. In a general way, mechanical ileus is characterized by its later onset, the presence of visible peristalsis, severe colicky pains with slight changes in the character and rate of the pulse, and little or no rise in the temperature at first, and asymmetrical distention. Where peritonitis is present, the picture is obscured, the infection masks the obstruction; the septic symptoms usually predominate. Where, following an operation, an ileus develops unaccompanied by the above-mentioned symptoms, one has probably to deal with the adynamic variety.

It goes without saying that it is important to determine the pathological condition present and its location both with reference to the portion of the intestinal canal obstructed and its place in the abdominal cavity. In some cases it is comparatively easy to accomplish both of these desired results; in other cases it is manifestly impossible.

The location of pain, its colicky character, tenderness and swelling, asymmetrical enlargement, patterns of distended coils of intestine, localized areas of dulness or tympany, character of vomitus, examination of the urine and blood, audible gurgling, etc., are all of great value taken collectively, but, individually, no one of them is of any special diagnostic significance. Colicky pains, "trouble with the bowels," distention, etc., occurring within a few days after abdominal operation, or even some months or years later, should make one suspicious at once of the possibility of a partial or beginning intestinal obstruction, and if these symptoms continue unrelieved for any length of time, should raise the question of the advisability of an immediate exploratory operation.

Since this condition when unrelieved leads to a long train of serious consequences, so far as the patient's health and life are concerned, such as disturbances in the circulation of the mesentery and bowel and their sequelæ, hyperæmia and hæmorrhage with infarct, ulceration and gangrene of the bowel, the absorption of toxines from the obstructed loop of intestine, great distention of the intestine, etc., it is of the utmost importance that every endeavor should be made to establish an early diagnosis and bring about adequate relief.

As to the causation of the different forms of ileus, the early obstructions are in the vast majority of instances due directly to infection and its results. The later cases are more often due to old inflammatory adhesions which may have been drawn out into the form of bands and around or beneath which coils of intestine have become constricted. It will be seen, therefore, that the septic or adynamic forms of ileus occur more frequently in the early obstructions, while in the later ones the mechanical variety predominates.

Just why inflammation of the peritoneum causes intestinal paresis, whether it is due to œdema or reflex action, vasomotor disturbances, or the local effect of the toxines upon the nerves of the intestine, is not known, but that all these factors are concerned is highly probable.

The symptomatology of ileus varies with the causation. In the early cases where the possibility of infection exists, one is likely to find in certain cases symptoms suggesting peritoneal inflammation, more or less localized. It is very difficult, indeed impossible, in many cases to differentiate between a peritonitis and an ileus whether mechanical or adynamic. In fact, as has been said, one meets not infrequently with cases in which they coexist. For instance, Case II of our series, where on the fourth day after an operation for the removal of a gangrenous perforated appendix in which a spreading peritonitis was found present, symptoms of ileus developed. Through the wound of the previous operation I exposed and incised a distended coil of intestine, and through a rectal-tube irrigated this loop of bowel. While passing the tube into the bowel through this fistulous opening, and distending it with water from a fountain syringe, a sudden loud gurgle was heard and in a short time the patient had a free evacuation with a passage of a large amount of flatus and complete relief from his symptoms. The symptoms presented by this patient are those usually met with in cases of mechanical ileus, namely, colicky pains accompanied by distention more or less localized, visible peristalsis, and later the appearance of vomiting and obstinate constipation with marked restlessness, yet at the primary operation a well-marked peritonitis had been present. Where symptoms such as these develop shortly after a surgical operation, particularly when there has been some infection of the peritoneal cavity requiring drainage, one should be suspicious at once of the development of an obstruction. Instead of drenching the patient with cathartics, enemata and gentle massage of the abdomen, where the patient's condition admits of it, should be tried. Moderate attempts at catharsis are not contraindicated as a rule, but these failing, further efforts in this direction should be discontinued. Recourse should be had at once to other aids in establishing a diagnosis. A leucocyte count may be of some assistance, but unfortunately the leucocytes are usually found increased in the presence of intestinal obstruction as well as in inflammatory conditions. Some of the highest counts we have observed have been in this connection.

During the past few months Dr. Charles E. Simon has investigated the opsonic content of the blood of a series of abdominal operations which occurred in my service at the Union Protestant Infirmary. He was particularly impressed by the very high values which he obtained in certain cases of appendicitis. Making use of his method of dilution, which has been described in the January number of the Johns Hopkins Hospital Bulletin[10] he found that in these cases phagocytosis to the extent of from ninety to one hundred per cent. may still be demonstrable with a dilution of 1.30 and even at 1.40, as contrasted with an average normal value of thirty-five for a dilution of 1.30 and of nine for 1.40. In a small number of obstructive cases, on the other hand, values were obtained which were essentially normal. I accordingly suggested that experiments be undertaken to ascertain to what extent the determination of the opsonic content of the blood might be of service in distinguishing between infective and primarily obstructive cases. This work has been conducted by Dr. Nelson of the Infirmary staff in association with Dr. Simon. Dogs were used for the experiments and obstruction produced by ligating the intestine with tape or broad pieces of gauze. The absolute leucocyte count, the differential count, and the opsonic content were determined before operation, and thereafter three times in the twenty-four hours until the death of the animal, or until recovery had taken place. Unfortunately the number of experiments of which I have notes is small, as the investigation was only begun a few weeks ago. The work, however, is being continued and I will probably have occasion in the future to revert to it.

From the experiments which have been made, it is clear that neither the absolute nor the relative count *per se* will suffice to differentiate a simple obstructive from an inflammatory condition of the peritoneal cavity. In one of the dogs the absolute count reached a remarkable height,—viz., 62,000 within twenty-four hours after the ligature had been applied. The relative count also did not prove to be of service. Polynuclear, neutrophilic increase associated with eosinophilic decrease, which is to be constantly met with in infections with the common pus organisms and which Dr. Simon speaks of as the septic factor, was likewise met with in the obstruction experiments.

The opsonic curve on the other hand is rather interesting.

Generally speaking the values indicate fluctuations which for the low dilution of 1.10 may show a periodical increase, but on the whole there is but little deviation from what we may regard as normal for the dog. With the 1.20 dilution on the other hand, the figures are rather subnormal than normal in value. There is at no time evident a well-maintained increase such as is seen in the human being in certain infections.

As I have remarked, our series of animal experiments is as yet too small to warrant any definite conclusions, but the results obtained appear suggestive and worthy of further study.

Much importance was attached at one time to the examination of the urine. It was hoped, owing to the encouraging report of Jaffe,[12] that the presence of increased amounts of indican in the urine would be of considerable importance as a diagnostic aid but later observations have shown this substance to be present in increased amounts in certain constitutional diseases,—for instance, anæmias, starvation, empyema, cancer of the uterus and stomach, etc. In fact, it can usually be obtained in increased amount where any extensive suppurative process is present in any part of the body. Gehrhardt points out that therefore indicanuria can be of diagnostic value in intestinal obstruction only when all these other conditions can be excluded. As this test is of value only in obstructions of the small intestine, its field of usefulness is necessarily limited, and, for the reasons already stated, it is practically valueless.

Vomiting in these cases is an early and important diagnostic sign and usually becomes pronounced.

Reversed peristalsis is usually assigned as the cause of this phenomenon but the experimental researches of Magendie,[13] Roger,[14] Loevinsohn[15] and others tend to discredit this assumption, and show that the abdominal muscles are very largely concerned in its production. Mall's[16] interesting experiments would also rather confirm this view.

The distention noted is due to the rapid formation of gas in the lumen of the intestine. It is interesting to note that physiologists are singularly silent as to the method of gas production in the intestine. Krehl[17] in his work states that the gas normally found in the intestine, and in much larger quantities in cases of peritonitis, ileus, etc., may have two sources, viz.: (1) The swallowed air. This consists of oxygen and hydrogen, the former readily absorbed by the blood while the latter is absorbed with difficulty and is what would be found chiefly in the intestine. In the meteorism of hysterical patients, he thinks this is the chief source, especially as in this condition the tonicity of the intestinal wall may be supposed to be lowered, and this would allow of greater distention. (2) The gas produced by fermentation, such as hydrogen, marsh gas, carbon dioxide, sulphurated hydrogen and nitrogen. The carbon-dioxide would be absorbed quickly, the sulphurated hydrogen would give an odor, but is produced in small quantity and only from proteid. It would also be absorbed quickly, so that the hydrogen, marsh gas and nitrogen would be the ones likely to give rise to distention.

In cases of obstruction and shock, this distention might be great, owing to the loss of tonicity in the bowel-walls, which would prevent their passing on the gas, and also prevent the normal digestion of the food and thus give a greater chance for fermentation. Along with this there is also a markedly lowered power of absorption from the intestinal mucous membrane, which would augment the accumulation of gases and also retard the normal digestion of the food, leaving it a prey to the bacteria present in the intestinal canal. Fermentation may thus proceed very rapidly under these conditions and the laxity of the walls of the intestine would, of course, facilitate the accumulation of gases both by preventing their onward movement and by obstructing the circulation in the intestine.

In this connection and as helping to explain the restlessness and later the great prostration noticed in advanced cases of ileus, the work of Nesbitt,[18] and Clairmont and Ranzi[10] is most interesting. Nesbitt in some experimental work conducted upon dogs in the pharmacological laboratory of the Johns Hopkins University found in complete occlusion of the small intestine at its lower end, the constant occurrence of cholin and neurin along with other bases, provided the food ingested contained any considerable quantity of lecithin. It is not improbable, he thinks, that still other poisonous substances are formed by bacterial action from other constituents of the food in cases of intestinal obstruction. While cholin is relatively harmless in its action, neurin must be classed with the exceedingly active poisons. It has been conclusively shown by Nesbitt and other observers quoted by him that neurin may be formed from cholin by bacterial action. In its physiological effect, neurin is very like muscarin. Especially to be noted here is its paralytic action on the heart and its effect upon the intestinal movements. This work explains certain clinical phenomena observed, and proves conclusively that highly toxic substances are formed in the intestinal canal during its complete occlusion. Lavage of the stomach and intestine will mechanically lessen the amount of toxic substances absorbed.

This fact is well illustrated in Case IX of our series where on the fifth day after the removal of a gangrenous perforated appendix, symptoms of ileus developed, one of the most marked features of which was intense restlessness. After incising a distended coil of intestine through the wound, and evacuating a large amount of fluid contents and thoroughly irrigating the neighboring coils of intestine through a rectal-tube, his condition at once improved and his restlessness and delirium very quickly disappeared, accompanied by a corresponding drop in the pulse rate. Six days later, when the intestinal fistula spontaneously closed, a recurrence of these symptoms was noted, which was promptly relieved by reopening and again irrigating the intestine.

Nesbitt further points out that if the fate of lecithin in the intestinal canal, which is not definitely known, is as Broca assumes, then caution should be observed in the use of certain foods that have been considered heretofore most nutritious and healthful. Chief among these are eggs, which are rich in lecithin and which when broken up in the intestinal canal by bacterial action may under certain conditions set free large amounts of poisonous neurin.

Clairmont and Ranzi in their interesting paper point out the fact that the filtrate of normal intestinal contents injected into animals produces no results, while the filtrate from the afferent loop of an ileus produces very grave and even fatal results when injected into animals in large enough doses. These experimenters also found that the filtrate from the intestinal contents of an ileus of the small intestine possesses much more marked toxic qualities than that from the large bowel, and that the symptoms were the same in experimental ileus in animals as in the human subject. Kukula [20] has been able to isolate putrecin from the contents of a strangulated loop of bowel in a hernial sac. These observations all help to explain the toxæmia and paresis of the bowel observed as one of the later phenomena to develop in the course of an intestinal obstruction.

The shock and intense depression observed in the unrelieved cases is accounted for by the disturbed circulation in the obstructed portion and by the absorption from the afferent loop of poisonous toxines such as those described by these observers, in quantities sufficient to give rise to profound depression of the vital centres and at times even to death itself.

F. T. Murphy, of Boston (private communication), in some observations on experimentally-produced ileus in cats finds that an obstruction to the venous flow in the constricted loop was the greatest factor in producing the classical symptoms. In cases where the arterial supply was cut off, the symptoms were fairly well marked after eighteen to twenty-four hours. If examined after one-half hour, very little change was found in the obstructed loop.

In cases where the arterial supply was not cut off, but where the venous return was obstructed, there was very evident and almost immediate distress.

Within thirty minutes to an hour the animals vomited and lost their muscular tone. These animals usually died within twenty-four to thirty-six hours. The abdomen opened one-half hour after such an operation, showed the walls of the obstructed loop markedly discolored and œdematous and much bloody fluid was found in the abdominal cavity.

Microscopically, the intestine with the obstruction to the venous return showed much more rapid and greater destruction to the mucous membrane than those with the arterial supply or the whole mesentery cut off.

Murphy thinks a vasomotor paralysis plays an important part in the production of the collapse so frequently noted in severe cases. In the production of this paralysis, the obstruction of the venous flow seems to be the important factor.

As to the frequency of occurrence of this complication, as already indicated from my own experience, and after a more or less careful survey of the literature, it can be stated that it is by no means rare. It is rather remarkable, in fact, that it is not more frequent when one considers the vast number of operations being constantly performed, and that by surgeons of limited experience, unskilled in the niceties of surgical manipulation and in the refinements of the art, where unnecessary traumatism of the exposed peritoneal surfaces is not infrequently inflicted. This, together with faulty methods of peritoneal drainage and deficient care of patients after surgical operations, makes it rather a source of wonderment that so few instead of so many cases are the subject of this grave complication. Undoubtedly some deaths are attributed to peritonitis which are due to intestinal obstruction and *vice versa*.

The symptoms of the two conditions, as pointed out by Warbasse,[21] are so nearly identical as to make the diagnosis at times very difficult. "The clinical pictures," said he "are so similar that were it not for the peculiar symptom of the rigidity of the abdominal muscles observed in peritonitis, it is often difficult or impossible to distinguish intestinal obstruction from peritonitis. Clinically, paresis of the bowel is the same as intestinal obstruction, and gives rise to the same symptoms."

Peck [22] points out that many of the cases of postoperative obstruction are due to kinks and bands which partially constrict the lumen of the bowel, until an attack of indigestion or some indiscretion in diet, produces an unusual gas formation in the afferent loop, with increased peristalsis acting against the point immobilized by the adhesions. The obstruction thus becomes complete and gas ceases to pass the obstructed point. This is well illustrated by Case VIII of our series. This patient was a boy fourteen years of age who twelve days after the drainage of a large appendicular abscess developed the usual symptoms of intestinal obstruction. He had been progressing favorably except for slight difficulty in obtaining a satisfactory bowel movement, when after eating heartily of fruit cake given him by a foolish mother, vomiting, visible peristalsis, meteorism and obstinate constipation developed. His leucocytes advanced from normal to twenty-two thousand. After enemata and mild cathartics had failed, the abdomen was reopened. The second incision was made through the left rectus because he referred his pain to this side and the visible peristalsis seemed to stop at this point. A kinked loop of ileum was found adherent about a small localized abscess between coils of intestine; this was evacuated and disinfected, the loop freed, and the abdomen closed. The patient made a prompt recovery.

In some cases early palliative treatment may be effective in avoiding the necessity for a secondary surgical operation. Provided the obstruction is in the large bowel, it may be possible to straighten out the kink or possibly disentangle a volvulus by elevating the patient's hips, distending the large intestine with water through a tube passed into the rectum, abdominal massage, atropine in large doses, etc. This is illustrated by two cases in my series, one of which is of unusual interest on account of the number of times volvulus has developed and been relieved in this manner.

This patient, a man, aged forty-seven years, was first admitted to the Johns Hopkins Hospital in January, 1890, with a history of definite intestinal obstruction lasting for six days. The history suggested volvulus of the sigmoid. Attempts were made to relieve by large enemata but to no avail. Dr. Halsted operated; median incision. Colon enormously distended down to the sigmoid, which was found to be the seat of a complete volvulus. No peritonitis, mesosigmoid large and broad; volvulus untwisted. Closed without drainage.

The patient had no recurrence until two years later, when he returned to the hospital with a history of obstruction of five days' duration. Enemata gave only partial relief. After several days an operation was performed; some coils of small intestine were found adherent to the line of previous incision. A long narrow band 5 mm. in diameter, 15 cm. long, extending from a point on the descending colon to the anterior abdominal wall. A loop of descending colon was caught behind this and almost completely constricted. The band was ligated and excised. The colon was enormously distended and mesocolon abnormally long throughout its entire length. A complete volvulus of the sigmoid was found. Recovery good.

Since that time up to January 1, 1906, the date of his last admission, he has returned to the hospital just twenty-eight times, averaging two attacks a year, for the relief of his recurrent obstruction. It has been possible in all of these attacks to relieve him completely by elevating the hips and distending the rectum and sigmoid with water. I may add that he will not agree to a radical operation directed toward preventing the recurrence, preferring to get along as he is.

The other was a youth of 19, operated upon during an attack of mild catarrhal appendicitis. The patient made an uninterrupted recovery for five days, when he began to complain of some discomfort in the bowels, which had not been satisfactorily moved up to this time. Enemata only partially effectual. Cathartics no better. On the eighth day he began to vomit and visible peristalsis was noted. Temperature slightly elevated. Abdomen moderately distended. His pain was referred to the left lower quadrant. The patient's hips were well elevated and the rectum and sigmoid distended with large enemata. Vigorous massage and kneading of the abdomen were administered at the same time. After one-half hour of this, an audible gurgle was heard and in a few minutes a copious movement of the bowels took place, with the escape of a large quantity of flatus, accompanied with complete relief of his symptoms.

Dr. Thomas S. Cullen has kindly furnished me with a report of a somewhat similar case, a patient of his who ten days after an operation for diffuse peritonitis from a ruptured appendix developed symptoms of intestinal obstruction. The patient lived a long distance in the country, and three days after obstructive symptoms had developed he was removed to the city, which necessitated a long drive over rough roads with a good deal of jolting. When he arrived at the hospital his condition was better, his vomiting, which had been fecal in character, subsided, and he shortly had a succession of bowel movements with complete relief of his symptoms.

A point of considerable interest to all abdominal surgeons is the question of the formation and disappearance of adhesions in certain cases where the abdomen had been opened and found to be the seat of a well-developed peritonitis. The fact that in some cases the adhesions disappear completely and that early, and in others they do not disappear at all, or, at any rate, to a very much less extent, has been noted by many observers. The reason for this is, to my mind, not altogether clear. The presence of fluid, salt solution, effusions of one sort or another, etc., have been assigned by some as the cause for their nonappearance. Early change of position, massage, vigorous catharsis, doing away with drainage, lessening traumatism, absence of all foreign bodies in the peritoneal cavity, have been assigned by others.

I was much impressed in one case of my series by the absence of adhesions, Case XI—Dr. G., upon whom I had operated three weeks previously for a perforating typhoid ulcer with the existence of a widespread peritonitis. At that time, I was in the habit (a practice which I have since discontinued) of irrigating thoroughly the peritoneal cavity and removing by vigorous wiping with pledgets of gauze the fibrin adherent to the intestinal loops. This had been thoroughly done after a more or less complete evisceration. At the time of the second operation, three weeks later, not a single adhesion could be found in the abdominal cavity except at the point of suture of the perforating ulcer, which had adhered to another coil of small intestine and produced a sharp angulation of the adherent coil, which in turn had given rise to the obstruction.

On the other hand, in Cases IV and VII adhesions of the densest character were found matting the intestines together into a fused mass which it was impossible to unravel. All three of these cases had been subjected to the same treatment; traumatism of the intestinal coils more or less marked, well-marked peritonitis, extensive gauze drain, intestinal paresis quite well developed for several days after the initial operation, etc., with diametrically opposite results, so far as the formation of adhesions was concerned.

This brings up the question of the ability of the surgeon to limit the formation of peritoneal adhesions. My experience leads me to believe that the production of adhesions and their subsequent disappearance is a matter over which the surgeon has little control. One can do a certain amount toward preventing their formation, but it is impossible to prevent them altogether. Sonnenberg, quoted by Loevinsohn, is of the opinion that toxines passing through the intact bowel-wall give rise to adhesions in those cases where they are present without demonstrable lesion.

Baisch reports a series of experiments upon animals intended to show the causation. He produced a variety of lesions of the peritoneum, parietal and visceral. He concludes from his observations that the formation of adhesions is dependent upon the presence of blood, even in minute quantity, in the peritoneal cavity. He conducted two series of experiments, producing similar lesions in each. In the one complete hæmostasis was employed. In the other, varying amounts of blood were allowed to remain in the peritoneal cavity. In the first series, no adhesions developed, while in the other they were constantly found present.

In support of this proposition, he quotes the statistics from Zweifel's clinic, noted for his blood-free technique, who, in eight hundred laparotomies, had only two cases of postoperative ileus, both of which occurred in cases exhibiting extensive adhesions at the time of the primary operation.

Martin has recommended the application of sterile oil to the denuded areas.

Cargile membrane has a very limited usefulness. The presence of fluids,—for instance, salt solution, in the abdominal cavity is of doubtful efficacy owing to the rapidity of absorption.

W. J. Mayo's [23] suggestion that the presence of fluid in the abdomen prevents the formation of adhesions in the case of tuberculous peritonitis is probably correct, but in that disease the fluid is in quite large amount and remains for a long time. The two conditions are hardly analogous.

The limiting of the amount of packing and the use of materials which least excite adhesive peritonitis are to be recommended. It is well to avoid drainage altogether where possible, but, in case it is necessary, the greatest care should be exercised in the proper placing of the drain. If a drain can be so placed as to be surrounded on the one side by visceral and on the other by parietal peritoneum, the chances of the formation of obstructive adhesions are much lessened.

Early catharsis, recommended by some, is of questionable value. In fact, it seems to me to be contraindicated in a considerable number of cases. The early rather extravagant claims of the advocates of atropine and eserine have not been borne out by more extensive observations. Frequent change of position may be of advantage in certain conditions. It is obviously impossible in others. For instance, in that interesting group of cases of dilatation of the duodenum and stomach, gastromesenteric ileus (of Zade) due to obstruction of the duodenum by the superior mesenteric vessels, associated with Glenard's disease, it is indicated. In one of the fatal cases of my series, this was the cause of death.

This patient, a woman, aged forty-six, had been operated upon eighteen months previously by another surgeon for some pelvic trouble. On September 7, 1904, I did a pyloroplasty for persistent indigestion, nausea and vomiting. The pylorus was somewhat contracted with a scar on the anterior wall. The stomach moderately dilated; pylorus and duodenum high up under the liver. The patient began vomiting after recovery from ether. This persisted unrelieved for seven days in spite of lavage, etc. Vomitus odorless, bile-stained. Pulse rapid, weak throughout. Bowels moved well. Patient had slight cough. Died seven days following operation.

Autopsy showed beginning bronchopneumonia of left lung. Suture perfect; no sign of peritonitis; stomach moderately dilated, the first portion of the duodenum markedly so up to the point where it passes beneath the mesenteric vessels. Below this point the intestine was collapsed. On opening the intestine at this point, no lesion was found. Small intestine was pushed well down into the pelvis. Had a diagnosis of the cause of the ileus been made earlier, a change in position might have brought about relief.

It would lead us too far afield to discuss at this time this most interesting variety of ileus, originally described by Rokitansky[24] in 1842, and which has of late begun to attract attention among abdominal surgeons, but it is a fact worthy of note in passing that Dr. Byron Robinson,[25] of Chicago, in 1900 appears to have been the first one in this country to bring this condition to the attention of the profession in a publication. In a recent communication to the Johns Hopkins Medical Society, I gave credit to another, but on further investigation, I believe it properly belongs to Dr. Robinson, and I take this opportunity of correcting my former misstatement. Those who are interested, I would refer to Dr. Robinson's original article in the Cincinnati Lancet Clinic, December 8, 1900, and to the recent reviews of the subject by Zade,[26] Kelling[27] and Neck.[28]

From a study of my own series, it would appear that obstruction occurs in the majority of cases early,—that is, before the patient leaves the hospital, fourteen occurring early and twelve late, according to Broca's classification. The disparity in number between the two groups, however, does not seem to be as great as one would naturally suppose. Of the fourteen early ones, ten occurred within the first week, all within three weeks. Of the late cases, five occurred within six months and three were over five years.

Of my series of twenty-six cases, twenty-two were operated upon a second time for obstruction. Appendicitis, acute or chronic, seems to have been the most fruitful cause. Sixteen or 61.5 per cent. followed appendicitis, either acute or chronic. Two followed operations for strangulated hernia, two typhoid perforation, two cholelithiasis. One case each followed operations for pyloroplasty, tuberculous peritonitis, volvulus and nephrotomy. The last was the only case of my series in which the peritoneal cavity was unopened. Although only two cases of my series were associated with hernia, it is a very important etiological factor, as pointed out by Schede.

A most interesting case of postoperative obstruction has recently occurred in the Surgical Clinic at the Johns Hopkins Hospital. The patient, an old man, upon whom perineal prostatectomy had been performed by the house-surgeon, Dr. Sowers, gave a history of having had a right inguinal hernia for forty-five years and one on the left for four years. The note at the time says "a double inguinal hernia most marked on the left side. Easily reduced." During the operation for prostatectomy, both herniæ were reduced. The patient stood the operation well but vomiting began within a few hours. This continued in spite of lavage and rectal feeding. Abdominal pain was pronounced. Most of his pain was referred to the bladder and supposed to be due to the operation. Constipation was present, no result from the enemata.

On the second day it was noticed that the amount of urine was much diminished. It was supposed then that his trouble was due to suppression of the kidney function. His condition remained practically unchanged up to the time of his death, on the fifth day. His abdomen was only moderately distended and nothing specially noted here. It was supposed his death was due to suppression of urine and asthenia.

The autopsy showed a cloudy swelling of the kidneys. Marked arteriosclerosis. Intestinal coils were distended and pale except a number of coils in the right iliac fossa, which were dark red; the small intestine collapsed for a considerable distance from the ileocæcal valve. At this point a volvulus was found with a twist of one and one-half turns. On untwisting the intestine, the mesentery was found thickened and coils of intestine adherent to each other, and to the thickened mesentery by old fibrous adhesions; the reduction of the adherent hernial loops *en masse* had produced the obstruction. The diagnosis was obscured in this condition by the absence of signs referable to the hernia; the subjective symptoms all referred to the bladder.

The cause of obstruction was kinking in seven cases; adhesions alone, seven; bands, three; volvulus, two; loop caught beneath adherent loop, one; cicatricial stenosis, one; gastro-mesenteric ileus, one; adynamic ileus, one; cause unknown in three. In twenty-three of the cases the cause of obstruction was definitely known. Of these, in eighteen, or 78 per cent., the obstruction occurred either directly or indirectly as the result of peritoneal adhesions. It will thus be seen that of all the factors concerned in the causation of intestinal obstruction, peritoneal adhesions exercise by far the greatest influence.

The seat of the obstruction was in the small intestine in twenty cases, within the lower twelve inches of the ileum ten, exact position not stated ten, pylorus or duodenum three, sigmoid two, ascending colon one.

Peritonitis more or less general was present at the time of the primary operation in fifteen cases. At the time of the secondary operation it was found present in eight. It was the cause of death in three of the fatal cases. The treatment employed was freeing of the adhesions in nine cases, enterostomy in nine, primary intestinal anastomosis in two, exploratory laparotomy, nothing done, in two; no operation in four.

Of the fatal cases, four died without relief from the obstruction, three from peritonitis, and three from symptoms suggesting toxæmia.

That drainage plays a very important part in the development of postoperative obstruction is agreed by all surgeons. It is somewhat surprising then to note that of our series, sixteen cases were drained, whereas ten, 38.4 per cent., were not drained. Drainage, therefore, is not the only factor to be considered.

Enterostomy was performed nine times; in three instances it was followed later by a secondary anastomosis. Of these cases, four recovered and five died. The value of enterostomy in intestinal obstruction is as yet undetermined, but that it has a place and that it is a life-saving procedure in many instances cannot be gainsaid. That it has obvious objections, is equally apparent. In a recent communication by Dr. Pancoast and myself[20] we have called attention to some if its advantages. That I have saved life by the establishment of an intestinal fistula where more extensive operation was out of the question, I am perfectly convinced.

Where bands exist they should be excised, adhesions should be freed and the intestinal coils placed in as favorable position as possible to prevent obstruction from the formation of subsequent adhesions. Where the bowel has been injured and its viability is doubtful, it is better when possible to do immediate resection followed by anastomosis. This is illustrated by Case XXI, whom I operated upon for a strangulated femoral hernia. The bowel looked a bit doubtful, but owing to the patient's poor condition I deemed it wiser to take the chances and dropped the injured loop back into the abdominal cavity. She made a good recovery, but began to complain, after a few weeks, of symptoms of intestinal obstruction. These increased in severity until the obstruction became almost complete. Seven months after the initial operation, I reopened the abdomen and found an obstruction of the intestine due to a tight cicatricial contraction at the point where the bowel had been found constricted at the previous operation. The lumen at this point was not more than 5 mm. in diameter. I did a lateral suture anastomosis. She made a good recovery.

In my series, there was but one case of adynamic ileus unassociated with peritonitis and this was the only case in which the peritoneal cavity was unopened.

This patient, a man aged forty years, suffering from persistent hæmorrhage from the right kidney, was operated upon by another surgeon. I was present at the primary operation, which was very well done, no undue traumatism having been inflicted. The kidney was exposed without much difficulty, incised and drained. The patient stood the operation well but took the ether rather badly. Shortly after the operation, a moderate amount of meteorism developed, which persisted for four days in spite of all efforts to overcome it. During this time there was no movement of the bowels and vomiting had been persistent and most distressing. The vomitus was chiefly bile-stained fluid, containing no fecal odor. At the end of this time, the patient's condition becoming distinctly worse, it was thought best to explore.

I opened the abdomen on the fifth day and after a careful exploration of the entire abdominal contents, could find nothing except a universal distention of the intestinal tract. It seemed perhaps a little more marked in the ascending colon than elsewhere. There was no sign of peritonitis. A rectal tube was passed and a considerable amount of gas and feces was syphoned off by stripping the intestine downward in the direction of the fecal current. This was followed by only temporary relief, meteorism recurring on the next day. An enterostomy was performed in the hope of relieving the distention, but it was of no avail. Apparently an infection of the peritoneal cavity occurred at the point of the enterostomy wound, for some days later the patient died with symptoms of peritonitis.

Autopsy showed a fresh peritonitis starting from this point, grafted upon a universal distention of the intestinal coils. This was the only death in my experience that could in any way be traced to infection from the enterostomy opening.

As has been said before, postoperative ileus other than the mechanical variety is most frequently associated with an inflammation of the peritoneum, more or less widespread. That a circumscribed peritonitis will stop peristalsis cannot be denied. Just how this is brought about is not definitely known, but that it is at times observed associated with a very sharply localized peritonitis of a low grade, is illustrated by a case reported by Dr. Halsted.[30] This patient was operated upon for gall-stones. At the operation there was found an ileus of the first portion of the duodenum and the pyloric end of the stomach. Corresponding accurately to this distended portion of the bowel, was a slight peritonitis scarcely more than an injection of the serosa and an exudate only enough to cause very slight adhesions between the duodenum and gall-bladder. The vascular injection seemed to correspond accurately to the limits of the dilatation.

Disturbances more or less marked to the innervation and circulation of the bowel-wall are certainly important factors in the causation of these forms of ileus, but, in addition to this, it is highly probable that the absorption of toxines, as referred to earlier in this paper, from the obstructed portion of the bowel, plays a most important part, the full significance of which is not at present understood.

Reichel[31] has shown by experiments that artificial kinking of the intestine is of itself not enough to produce complete occlusion, but in addition there must be a surrounding peritonitis. He concludes that the greater number of such instances have peritonitis as the primary factor. Over-distention by large and frequently repeated enemata has been known to be followed by temporary intestinal paresis.

CONCLUSIONS.

(1) Broca's classification into early and late varieties simplifies the diagnosis. In the former class, which so fre-

quently is associated with peritonitis, the differential diagnosis as to variety is always difficult and often impossible. In the latter, which is composed almost exclusively of the mechanical form, it is usually easy.

(2) Adhesions are the chief factor to be reckoned with in an attempt to prevent the occurrence of postoperative ileus, and efforts directed toward this end are likely to be productive of the best results.

(3) That drainage exercises a marked influence in the production of adhesions cannot be denied.

(4) Treatment.—Prompt operation is indicated in every case after palliative measures have been given a fair trial and have failed. The character of the operation depends upon the nature of the obstruction and the condition of the patient.

(5) The prognosis is unfavorably influenced by the presence of infection. In its absence, it is excellent.

REPORT OF CASES.

CASE I.—Mr. M., aged 47, admitted January 9, 1890. History of obstruction of one week's duration. Volvulus of the sigmoid; mesosigmoid very long and broad. Gut untwisted and wound closed, without drainage.

Second admission, December 22, 1892. Similar symptoms as at previous operation of five days' duration.

Operation, December 29, 1892.—Small intestine adherent to the anterior abdominal wall at a distance of 10 cm. Long narrow band extending from a point on the descending colon to the anterior abdominal wall behind, where a loop of large intestine was caught. There was also a double volvulus of the sigmoid. This was untwisted, the band ligated and the abdominal wound closed. The patient was subsequently admitted twenty-eight times for obstruction. It has been possible in all of his subsequent attacks to relieve him by high enemata.

CASE II.—Mr. H., aged 53, admitted February 29, 1904, with symptoms of acute appendicitis and spreading peritonitis. Operation, appendectomy, irrigation of the abdominal cavity with salt solution, iodoform gauze drainage to the stump of the appendix and to the pelvis. About the fourth day he began to show symptoms of intestinal obstruction and an opening was made through the old incision into the intestine. On passing the rectal-tube into this opening, an obstruction was encountered, which gave way with immediate relief to the patient. The intestine was washed out and there was no further trouble. Fistula closed spontaneously.

Case III.—Miss F., aged 42, had been operated upon twice previously, the first operation being for ventral fixation, the second for appendicitis (chronic).

At the second operation a McBurney incision was made and a chronic appendix was removed. A few fine adhesions around the right ovary. The wound was closed without drainage. Except for a slight constipation, the patient was well for seventeen months following the second operation, then she began suddenly to have severe abdominal pain after a full meal. This rapidly became worse; temperature and pulse remained normal. The abdomen was tense and quite hard, gurgling could be heard occasionally but no visible peristalsis. There was tenderness in the right iliac fossa. No vomiting. An enema gave no results.

Operation.—Right rectus incision; 12 inches of small intestine was found black and with a very foul odor. This was produced by a loop of intestine becoming adherent by a band to the region of the sigmoid, and with this as a centre a volvulus had taken place. The lower portion of the involved intestine was 6 cm. from the ileocæcal valve. The affected intestine was resected, an end-to-end anastomosis performed, and the wound closed without drainage.

The patient made a good recovery.

Case IV.—Mr. M., aged 28. Primary operation, appendectomy and drainage for acute appendicitis and general peritonitis. Right and left rectus incisions. Gauze drainage. Eighteen months after he developed symptoms of obstruction following a hearty meal. When seen twenty-four hours after the onset, there were colicky pains, distention, nausea and vomiting.

Operation.—The intestines were found much matted together by extensive adhesions, making it impossible to locate any definite point of obstruction. The most distended loop was brought into the wound and opened. The patient's condition became very bad on the table and he died twenty-four hours later unrelieved.

CASE V.—Mr. D., aged 16, admitted May 15, 1903. Primary operation, appendectomy and drainage of an appendix abscess for acute gangrenous appendicitis. Six months later the usual symptoms of obstruction appeared.

Operation.—One loop of ileum was found adherent posteriorly in the region of the cæcum. Another loop had slipped under this, producing an obstruction. The adhesion was freed, the loop beneath found in good condition and the abdomen closed without drainage.

Good recovery.

CASE VI.—G. W., aged 13, admitted May, 1902. Primary operation for acute appendicitis and general peritonitis. Appendectomy and gauze drainage.

Two years later he was taken with severe pain in the abdomen, of a crampy character, which had been present two days before admission. Vomiting had been persistent; abdomen distended; pulse 100; obstipation.

Operation.—A band was found extending from the scar to a loop of small intestine, which was partly twisted around it, causing an obstruction. Two other bands were found extending from the scar to other coils of the intestine but doing no harm. These were all resected and the abdomen closed.

Good recovery.

CASE VII.—Mr. B., aged 20. Primary operation, appendectomy for acute perforative appendicitis and general peritonitis. Large amount of gauze drainage. Patient has had four or five attacks since operation similar to the present one; last one six months ago.

Three days before admission he was taken with sudden cramp in the abdomen in the region of the old scar. Has vomited since the onset. Pulse and temperature have been normal; bowels have moved slightly with enemata. There has been no visible peristalsis. There is some deep tenderness to the right and above the umbilicus on palpation.

Operation.—Numerous loops were found adherent one to the other. No definite point of obstruction could be found. One acutely inflamed loop was left in the wound, packed about with gauze. Four days later an enterostomy was done at this point. One month later, a secondary laparotomy was done, but on account of the condition of the patient and the difficulty in locating the obstruction, a lateral anastomosis was made between loops above and below the mass of adherent intestine.

Good recovery.

Case VIII.—H. H., aged 14, admitted November 12, 1905. Primary operation, drainage of appendix abscess, appendix not found. Bowels moved well after the operation. Twelve days after the operation the patient began to complain of pain at intervals in left lower abdomen. At the time of the occurrence of a paroxysm of pain, there was tenderness in this region but not between. There was slight fulness of the abdomen on the left side; visible peristalsis was present.

On the following day the patient vomited quite frequently and peristalsis was much more marked. Enemata were ineffectual. No rise in pulse rate or in temperature.

Operation.—Left rectus incision; loop of small intestine was found kinked upon itself by some adhesions which had formed between it and the wall of the old abscess cavity. These were freed and the abdomen closed without drainage.

Good recovery.

Case IX.—Mr. W., aged 54, admitted October 31, 1904. Primary operation, appendectomy for acute perforative appendicitis and localized peritonitis; iodoform gauze drainage. Third day after operation, began to complain of distention and had some vomiting, which was relieved for the time being by stomach washing. On the fifth day symptoms of intestinal obstruction became more evident, vomiting had continued, enemata were only partially effectual, and restlessness had become a marked feature. Pulse at this time, 140.

Operation.—Enterostomy through the old wound. A large amount of fecal matter and gas was expelled and the intestine was washed out with salt solution. Following this, the patient's condition improved. Six days later the fistula closed with a return of the former toxic symptoms. Reopening the fistula resulted in almost immediate improvement.

Third operation, twenty-one days after primary operation.—A kink was found in the lower portion of the small intestine, due to adhesions about the original wound. This was freed and the abdomen closed. Following this, however, the patient did very badly and although infused and stimulated, died twenty-four hours later.

Case X.—Mrs. T., aged 39, admitted May 14, 1904. Primary operation, appendectomy for acute appendicitis and spreading peritonitis. Iodoform gauze drainage. The patient continued to vomit for thirty-six hours after the operation. There was a slight movement of the bowels on the second day. On the third day, however, vomiting again began and was persistent. The abdomen was symmetrically distended; enemata were entirely ineffectual; there was only a slight rise in the pulse rate.

Operation.—A distended loop was found in the old wound and opened. Irrigation into the efferent loop came out of the rectum, and it was found impossible to irrigate the afferent loop. Four hours later, under ether anæsthesia, the abdomen was opened through a left rectus incision. A distended loop was opened and the intestine emptied of its contents. It was then fixed in the abdominal wound. The patient was relieved in a short time. The enterostomy opening on the left side closed spontaneously; that on the right was closed by a lateral anastomosis five weeks later.

Case XI.—Dr. G., aged 25. Primary operation, laparotomy for typhoid perforation and spreading peritonitis. Iodoform gauze drainage. The patient had made a good recovery, and had been sitting up for two or three days, when the signs of an obstruction began to develop. This was between three and four weeks after the primary operation. There was pain, nausea, vomiting, asymmetrical swelling of the abdomen, much more marked upon the left than on the right side.

Operation.—A band was found stretching across from the old scar to the left lateral abdominal wall, obstructing beneath it a loop of small intestine. The band was resected with relief of the obstruction.

Good recovery.

Case XII.—Miss R., aged 24. Primary operation, appendectomy for chronic appendicitis. McBurney incision. Particular care was taken to turn in all raw surfaces and the mesoappendix. Six months later, the patient had symptoms of obstruction while at home in a distant city. Operation at that time by a local surgeon demonstrated an obstruction in a loop of small intestine due to kinking from an adhesion to the stump of the appendix. Adhesion divided and the abdomen closed.

Good recovery.

Case XIII.—Mr. L., aged 35, admitted February 4, 1902. Primary operation, appendectomy for acute perforated appendicitis and localized peritonitis. Iodoform gauze drainage. The patient did not do well; there was no distention, but bowels could not be moved and he suffered from constant nausea and vomiting. By the end of twenty-four hours he was vomiting almost continuously, large quantities of dark material being expelled every few minutes without effort. Lavage of the stomach afforded no relief. The face was drawn and pinched.

Operation.—A distended coil of intestine was opened through the old wound. Large amount of foul-smelling material escaped. Following this, the patient did well. Four months later, a lateral anastomosis was done to close the fistula.

Case XIV.—Mrs. S., aged 80, admitted February 1, 1905. Primary operation for gangrenous appendix. Iodoform gauze drainage. Second operation four months later for strangulated left femoral hernia. Six years after the primary operation, the patient was seized with severe abdominal cramps, nausea and vomiting which persisted for five days. Constipation had been present during this time. There had been no fever at any time. When seen by me, abdominal distention was marked, asymmetrical, being most pronounced in the right lower and left upper quadrant. The vomitus consisted of bile-stained mucus.

Operation.—On opening the abdominal cavity, the right lower quadrant was found filled with a sticky sero-purulent fluid. At the upper portion of the incision this was slightly bile-stained. On continuing the incision up toward the costal margin, the presence of bile became more pronounced. No perforation of the gall-bladder or ducts could be found. Intestines were everywhere distended and covered with lymph. Adhesions very pronounced, especially in the right lower quadrant, where an obstruction at the ileocæcal valve was made out. The patient's condition at this time became so grave that the operation was discontinued and the abdomen closed. She died a short time later.

Case XV.—Mr. P., aged 21, admitted August 19, 1902. Primary operation, laparotomy for typhoid perforation. Small perforation in the ileocæcal valve, closed with silk suture. Abdominal cavity irrigated with hot salt solution. Iodoform gauze drainage placed in the pelvis. The patient's condition the next day was very satisfactory; tenderness and muscle spasm over the abdomen were much less. At eleven o'clock P.M. the patient complained of abdominal pain and vomited; had slight movement of the bowels following enemata. Cramp-like abdominal pain complained of occasionally. The next morning, his condition not having improved, the abdominal wound was opened, gauze drainage removed and a distended loop brought into the abdominal wound, packed off with gauze and opened. The bowel was irrigated in both directions and a large quantity of fecal matter was washed out. The stomach and rectum were also washed out. Following this, the patient's condition seemed to improve and that night after the stomach, intestine and rectum were irrigated, the patient was decidedly relieved. This improvement continued for two days. On the following day he became worse, temperature and pulse both being elevated, and, in spite of all efforts toward stimulation, died two days later.

Autopsy showed a perforation 15 cm. from the ileocæcal valve which had been sutured but from which there had been some leakage. This, however, had been entirely walled off by adhesions which had produced a sharp kinking of the ileum at this point. There was no general peritonitis.

Case XVI.—Mr. S., aged 40, admitted January, 1906. Primary operation, nephrotomy and drainage for hæmorrhage from the right kidney. Lumbar incision. Peritoneal cavity not opened; patient came into the hospital morning of the operation, and bowels did not move with an enema. Vomited considerably more after ether than is usual and at intervals on the following day. The next day the vomitus began to have a brownish color and slight odor. There was considerable distention but no visible peristalsis. Up to this time, an enema had been ineffectual. In the afternoon of the second day quite a quantity of fluid fecal matter came through the rectal tube. On the third day, the distention became more marked; nausea and vomiting still present, and there was visible peristalsis. The patient became very restless and the pulse more elevated. No movement of the bowels.

On the fourth day the abdomen was opened and the small intestine found everywhere distended and also the cæcum. The transverse colon and sigmoid were collapsed. Some adhesions about the hepatic and splenic flexures were broken up, but these seemed hardly enough to produce the symptoms. A distended loop of small intestine was fixed in the wound with gauze. The next day, as the patient's condition was no better, the intestine was opened, with the escape of gas but no fecal matter. Attempts at washing out the intestine were unsuccessful, as it was found impossible to pass the stomach-tube for any distance. There was some improvement for thirty-six hours following the evacuation of gas but no relief of the obstruction, and the patient died four days after the secondary operation.

Autopsy showed a pretty widespread peritonitis with the lower six inches of ileum tightly bound down by adhesions, producing a stenosis in that region.

CASE XVII.—R. J., aged —, admitted May 9, 1903. Primary operation, appendectomy for perforated appendix with extensive spreading peritonitis. Gauze drainage to pelvis and stump of the appendix. Three months later the patient returned with symptoms of partial obstruction, crampy abdominal pains and vomiting at intervals. Bowels moved only slightly with enema.

Operation.—A number of adhesions were found between the neighboring coils; no definite kinking or other form of obstruction. Adhesions freed and abdomen closed.

Good recovery.

CASE XVIII.—Mr. McL., aged 19, admitted December, 1905. Primary operation, appendectomy for appendicitis probably associated with influenza. Wound closed without drainage. The patient did well until the fifth day, when after an attempt to move the bowels with cathartics and enema he developed pain in the left side with asymmetrical distention over this area. As his symptoms were not violent, further efforts were made to relieve the bowels during the next day. On the seventh day, distinct patterns were seen in the left side. Paroxysmal pains occurred, with audible gurgling; the distention had increased.

Treatment.—The patient's hips were then well elevated; the rectum was distended with several litres of water through a rectal-tube passed high. Vigorous kneading of the abdomen was practised. An audible gurgle was heard followed at once by copious fecal and gaseous discharge, with complete relief of symptoms.

CASE XIX.—Mr. F., aged 28, admitted August 25, 1902. The patient had a history of a previous attack of appendicitis, the last one being three weeks ago, and he came into the hospital for an interval operation. Operation.—Appendix found very adherent, running down into the pelvis. In freeing the tip a small abscess cavity was opened, necessitating the use of iodoform gauze drainage. Upon the second day following the operation he began to complain of distention and pain. Enemata have given no results; pulse slightly elevated. By the fourth day the distention was still present but the patient had had in the meantime six small stools; he has been vomiting occasionally, restlessness has been marked and the pulse has risen to 130.

Operation.—A kink in the small intestine was found near the situation of the drain; this was relieved. A loop of the ileum was then fixed in the abdominal wound, as the patient's condition was such that the operator did not feel warranted in searching for further obstruction. The patient was much shocked when taken off the table and did not recover, although the intestine was opened and washed out shortly after operation.

CASE XX.—Mrs. H., aged 46, admitted September 4, 1904. Primary operation, pyloroplasty for gastric neurosis and gastroptosis. The pylorus was slightly contracted and there was a wide scar on the anterior wall. Following the operation, the patient did badly; vomiting began shortly after the recovery from ether and persisted continuously for seven days until death. Vomitus had no odor and was usually green in color. Pulse remained rapid and weak throughout the whole period. Bowels had moved well.

Autopsy, anatomical diagnosis; partial obstruction of the duodenum and early bronchopneumonia of the left lung. Cholelithiasis, myomatous uterus. There was no leakage about the suture and no evidence of peritonitis. The stomach was moderately dilated, the duodenum considerably. To the right of the position where the duodenum passed beneath the greater mesenteric vessels it was dilated. To the left it was contracted. The sigmoid and ascending colon up to the hepatic flexure was dilated.

No obstruction at the position of the anastomosis. This finding suggests the possibility of a partial obstruction of the duodenum beneath the mesenteric vessels as a cause of death.

Case XXI.—Miss B., aged 45, admitted September 7, 1905. Primary operation, six months ago, for a radical cure of strangulated left inguinal hernia. No drainage. Ever since the patient left the hospital, she has had some general abdominal pain, slightly more marked on the right side below the level of the umbilicus. Has had indigestion and vomiting when the pains are severe. Constipation has been a marked symptom. Upon examination, a hard mass appeared close to the surface of the abdomen somewhat to the right and disappeared with an audible gurgle.

Secondary operation.—Lapatoromy. Cicatricial stenosis was found in the small intestine where it had been caught in the hernia sac at the time of the strangulation. A lateral anastomosis was done to short-circuit this area.

Good recovery.

Case XXII.—Miss G., aged 41, admitted May 24, 1902. Primary operation, radical cure for right femoral hernia. Following operation there was nausea and vomiting for two days. On the second day bowels moved with an enema, the patient ceased vomiting and was much more comfortable. On the fourth day vomiting began again and it was impossible to move the bowels with an enema. Pulse rose to 140. On the fifth day there was marked distention; pulse 160; vomiting had ceased. Bowels had not moved.

Operation on the fifth day.—Numerous adhesions were found about the appendix and sigmoid and lower lopps of the ileum. In suturing the sac of the femoral hernia the parietal peritoneum had been pulled upon where it was adherent to a coil of small intestine and thus produced a kink.

The patient died on the table.

Case XXIII.—Mr. F., aged 28, admitted June 1, 1905. Primary operation, six years ago, acute appendicitis. No drainage. He was well for two or three years. For the past three or four years he has complained of attacks of crampy pain in the right side, radiating to the umbilicus and right leg. The attacks varied in duration from a few hours to a few days. There is considerable belching after meals and borborygmus. No nausea or vomiting. Attacks have increased in frequency during the last few months.

Operation.—Numerous dense adhesions about the sigmoid and lower ileum. Very dense adhesions between the omentum and anterior surface of the sigmoid. These were divided and the wound closed.

Patient made a good recovery.

CASE XXIV.—Mr. S., aged 60, admitted September 12, 1903. Primary operation, cholecystostomy and drainage for stone in common duct. Large amount of iodoform gauze was used. For the first few days, the patient did not do very well. Had more than the usual amount of pain and discomfort and pulse remained elevated. On the tenth day he began to feel nauseated and vomited. Had been slightly delirious at times. From this time until the time of his death on the forty-first day after the operation, the patient was constantly nauseated and vomited almost every day. The vomitus was clear and colorless. The bowels moved every other day.

At autopsy there was found a twist at the pylorus, making an almost complete obstruction at this point.

CASE XXV.—Mr. B., aged 44, admitted July 1, 1903. Primary operation, cholecystotomy for stones in gall-bladder, cystic and hepatic ducts. Drainage consisted of tube in common duct surrounded by large amount of iodoform gauze. Did fairly well up to the seventh day, when he began to be slightly nauseated and drowsy. Following this, he became better for about ten days, but was only able to take liquid nourishment. On the twenty-second day he began vomiting again with no relation to time of taking nourishment. The vomitus was slightly blood-stained. This condition continued up to the forty-fourth day, when he died. The symptoms were practically the same as those in the preceding case. No autopsy.

CASE XXVI.—Mrs. C., aged 37, admitted May 17, 1901. Primary operation, five months previously, for intestinal obstruction due to tuberculous peritonitis. The obstruction was found to be due to adhesions of neighboring coils. These were separated and the wound closed.

Second admission.—The patient had been well up to three weeks ago, when she began to have uneasy sensations in the abdomen and constipation became more marked. Two days ago she had severe pain in the epigastrium, with nausea and vomiting. The abdomen became tense and hard, but there was only slight distention. During the night of the second day the vomitus became fecal. Pulse on admission, 104.

Operation.—The tuberculous process had improved markedly. The obstruction was found to be due to two bands which had caught and tightly bound a coil of intestine. These were ligated and divided and other bands which were thought might give trouble were also divided. The peritoneal cavity was irrigated with salt solution and the abdomen closed.

Good recovery.

BIBLIOGRAPHY.

[1] Baisch, Beiträge zur Geburts. und Gynaekol. Band. 9, 1905, p. 435.

[2] Wells, Die Krankheiten der Eierstocke. Leipzig, 1874.

[3] Schroeder, Bericht über 50 Ovariotomien Berl. klin. Wochenschr. 1879, No. 1.

[4] Olshausen, Die Krankheiten der Ovarien im Handbuch der allg. u. spez. Chir. v. Pitha-Billroth, 1879, S. 363 u. 1886, S. 626.

[5] Tuja, Des occlusions intestinals apres les laparotomies. Thése de Lyon, 1894,

[6] Rohe, American Jour. of Obstetrics, vol. xxx, 1894, p. 465.

[7] Schade, Uber Ileus nach Laparotomie. I. D. Gottingen, 1899.

[8] Corner, The Practitioner, Aug. 1905, p. 156.

[9] Hawkins, Diseases of the Vermiform Appendix, 1895.

[10] Simon, Johns Hopkins Hosp. Bull. Jan. 1906.

[11] Werth, Verh. d. Ges. dtsch. Naturf. u. Arzte, 1899, II Teil. S. 150.

[12] Jaffe, Virch. Arch. Bd. 70. S. 72.

[13] Magendie, Amer. Textbook of Physiology. Howell.

[14] Roger, La Tribune Médicale, Nov. 4, 1905.

[15] Loevinsohn, Mitt. a. d. Grenzgeb. d. Med. u. Chir. 1905, xiv, 620–681.

[16] Mall, Johns Hopkins Hospital Reports, Vol. 1.

[17] Krehl, Pathologische Physiologie.

[18] Nesbitt, The Journal of Experimental Medicine, 1899.

[19] Clairmont and Ranzi, Archiv f. klin. Chur. 1904. Bd. 73, p. 696.

[20] Kukula, Arch f. klin. Chur. Bd. 63, p. 773.

[21] Warbasse, Amer. Jour. of the Med. Sciences, July, 1905. p. 90.

[22] Peck, Annals Surgery, October, 1904.

[23] Mayo, Jour. Amer. Med. Ass., April 15, 1905.

[24] Rokitansky, Handbuch der Spec. Pathol. Anatomie (1 Aufl.) 1842. Bd. II, S. 215, 3. Aufl. 1863.

[25] Robinson, Cincinnati Lancet-Clinic, Dec. 8, 1900.

[26] Zade, Beit. z. klin. Chur., 1905, xlvi, 388–404.

[27] Kelling, Archiv f. klin. Chur. Bd. 64, p. 393, 1901.

[28] Neck, Cent. f. d. Grenz. der Med. u. Chir., August, 1905. Vol. 8.

[29] Finney and Pancoast, Amer. Med., Aug 22, 1903, p. 305.

[30] Halsted, Johns Hopkins Hosp. Bull., January, 1900, p. 16.

[31] Reichel, Deutsch. Ziet. f. Chir., Bd. 35, S. 495.